The opinion in support of the decision being entered today was *not* written for publication and is *not* binding precedent of the Board.
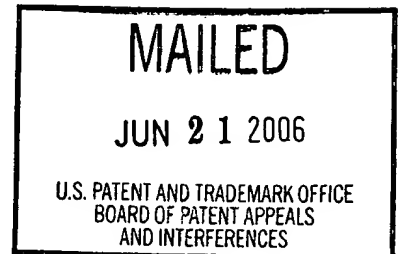
UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte HONG H. JIANG, ALLEN H. SIMON, and VAL G. COOK

Appeal No. 2006-1605
Application No. 09/470,741

ON BRIEF

Before BARRY, BLANKENSHIP, and HOMERE, **Administrative Patent Judges.**

HOMERE, **Administrative Patent Judge.**

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 1-9, 12-21 and 23-34, all of which are pending in this application. Claims 10 and 22 have been cancelled by Appellants.

Invention

Appellants' invention relates generally to a method and an article of manufacture having a storage medium and instructions stored thereon for performing video image decoding, as depicted in Figure 2. To decode the video image, a compressed video image is first down sampled in the frequency domain (230). Next, the down sampled video image is inverse-transformed (220). Further, the inverse-transformed down sampled image is fed into a motion compensation module to thereby perform a motion compensation for the down-sampled image in the spatial domain (210). The motion compensation includes scaling a motion vector in accordance with a down sampling ratio, wherein the motion vector specifies the relative distance of reference data from a macroblock.

Claim 1 is representative of the claimed invention and is reproduced as follows:

1. A method of performing video image decoding comprising:

downsampling a compressed video image in the frequency domain;

inverse transforming the downsampled video image; and

performing motion compensation for the downsampled image in the spatial domain, the performing of the motion compensation comprising scaling a motion vector in accordance with a downsampling ratio, the motion vector specifying relative distance of reference data from a macroblock.

References

The Examiner relies on the following references:

Ng	5,262,854	Nov. 16, 1993
Kim et al.	6,175,592	Jan. 16, 2001
Bose et al.	6,215,822	Apr. 10, 2001
Rosman et al.	6,222,550	Apr. 24, 2001

Vetro et al., "Frequency Domain Down-Conversion of HDTV Using Optimal Motion Compensation Scheme," International Journal of Imaging System and Technology, vol. 9, no. 4 (August 1998), pp. 1-16.

Dugad et al., " A Fast Scheme of Altering Resolution in the Compressed Domain" Computer Vision and Pattern Recognition, 1999 IEEE Computer Society Conference, Vol. 1 (June 1999), pp. 213-218.

Rejections At Issue

A.   Claims 1-7, 9, 11-12, 16-19, 21-24, 28-30 and 32-34 stand rejected under 35 U.S.C. § 103 as being unpatentable over the combination of Vetro et al., Ng and Bose et al.

B.   Claims 8 and 31 stand rejected under 35 U.S.C. § 103 as being unpatentable over the combination of Vetro et al., Ng, Bose et al and Kim et al.

C.   Claims 14 and 26 stand rejected under 35 U.S.C. § 103 as

being unpatentable over the combination of Vetro et al., Ng, Bose

et al. and Dugad et al.

D.   Claims 15 and 27 stand rejected under 35 USC 103 as being

unpatentable over the combination of Vetro et al., Ng, Bose et

al., Dugad et al. and Rosman et al.

Rather than reiterating the arguments of Appellants and the

Examiner, the opinion refers to respective details in the Briefs[1]

and the Examiner's Answer.[2] Only those arguments actually made by

Appellants have been considered in this decision. Arguments

which Appellants could have made but chose not to make in the

Briefs have not been taken into consideration. See 37 CFR

41.37(c)(1) (vii) (eff. Sept. 13, 2004).

OPINION

In reaching our decision in this appeal, we have carefully

considered the subject matter on appeal, the Examiner's

rejections, the arguments in support of the rejections and the

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1 Appellants filed an Appeal Brief on June 02, 2003. Appellants filed a Reply
Brief on August 19, 2003.
2 The Examiner mailed an Examiner's Answer on July 15, 2003. Examiner mailed
an office communication on February 22, 2006, stating that the Reply Brief has
been noted and acknowledged.

evidence of obviousness relied upon by the Examiner as support for the rejections. We have likewise reviewed and taken into consideration Appellants' arguments set forth in the Briefs along with the Examiner's rationale in support of the rejections and arguments in the rebuttal set forth in the Examiner's Answer. After full consideration of the record before us, we agree with the Examiner that claims 1-7, 9, 11-12, 16-19, 21-24, 28-30 and 32-34 are properly rejected under 35 USC 103 as being unpatentable over the combination of Vetro et al. ("Vetro"), Ng and Bose et al. ("Bose"). Next, we agree with the Examiner that claims 8 and 31 are properly rejected under 35 USC 103 as being unpatentable over the combination of Vetro, Ng, Bose and Kim et al. ("Kim"). We further agree with the Examiner that claims 14 and 26 are properly rejected under 35 USC 103 as being unpatentable over the combination of Vetro, Ng , Bose and Dugad et al. ("Dugad"). Last, we agree with the Examiner that claims 15 and 27 are properly rejected under 35 USC 103 as being unpatentable over the combination of Vetro, Ng, Bose, Dugad and Rosman et al. ("Rosman"). Accordingly, we affirm the Examiner's rejections of claims 1-9, 12-21, and 23-34 for the reasons set forth **infra**.

I.   Under 35 USC § 103, is the Rejection of Claims 1-7, 9, 11-12, 16-19, 21-24, 28-30 and 32-34 as being Unpatentable Over the Combination of Vetro, Ng and Bose Proper?

In rejecting claims under 35 U.S.C. § 103, the Examiner bears the initial burden of establishing a **prima facie** case of obviousness. **In re Oetiker,** 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). **See also In re Piasecki,** 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984). The Examiner can satisfy this burden by showing that some objective teaching in the prior art or knowledge generally available to one of ordinary skill in the art suggests the claimed subject matter. **In re Fine,** 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Only if this initial burden is met does the burden of coming forward with evidence or argument shift to the Appellants. **Oetiker,** 977 F.2d at 1445, 24 USPQ2d at 1444. **See also Piasecki,** 745 F.2d at 1472, 223 USPQ at 788.

An obviousness analysis commences with a review and consideration of all the pertinent evidence and arguments. "In reviewing the [E]xaminer's decision on appeal, the Board must

necessarily weigh all of the evidence and argument." **Oetiker,**
977 F.2d at 1445, 24 USPQ2d at 1444. "[T]he Board must not only
assure that the requisite findings are made, based on evidence of
record, but must also explain the reasoning by which the findings
are deemed to support the agency's conclusion." **In re Lee,** 277
F.3d 1338, 1344, 61 USPQ2d 1430, 1434 (Fed. Cir. 2002).

With respect to claims 1-7, 9, 11-12, 16-19, 21-24, 28-30
and 32-34, Appellants argue at pages 30 through 33 of the Appeal
Brief that the proposed combination of Vetro, Ng and Bose does
not teach the step of performing motion compensation for the
down-sampled image in the spatial domain, wherein the step of
performing the motion compensation includes the further step of
scaling a motion vector in accordance with a down sampling ratio,
and wherein the motion vector specifies the relative distance of
reference data from a macroblock, as required by the claimed
invention. Appellants also argue that there is no motivation to
combine the cited references since they teach starkly different

uses of motion vectors. Particularly, at page 30 of the Appeal

Brief, Appellants state the following:

> Contrary to the Examiner's assertions, the "motion
> vectors" disclosed in Vetro et al. are vastly different
> in purpose, effect, result and operation from the
> "motion vectors" disclosed in Ng. (Vetro et al. Section
> 4.3, page 11, Bose et al., col. 17, lines 4-25, and Ng,
> col. 4, lines 34-39). Also contrary to the Examiner's
> assertion, there is no motivation or suggestion in any
> of the this (sic) prior art to selectively combine the
> teachings of Vetro et al., Bose et al., and Ng in the
> manner contemplated by the Examiner. Additionally,
> given the stark differences between the "motion
> vectors" disclosed in Vetro et al., Bose et al., and
> Ng, none of this prior art, whether taken singly or in
> combination, can be said to suggest to those skilled in
> the art either the desirability of the selective
> combination of teachings of Vetro et al. and Ng
> proffered by the Examiner, or a reasonable likelihood
> of this selective combination.

Appellants further expand on this same argument in the Reply

Brief. In particular, at pages 3 and 4 of the Reply Brief,

Appellants state the following:

> Nothing in Vetro et al., Ng and Bose et al. discloses
> or suggests the desirability of reconciling these
> mutually different teachings in a manner that would
> suggest the claimed invention. Despite these
> deficiencies in the prior art proffered by the
> Examiner, the Examiner apparently takes the position
> that "as long as either Vetro or Ng teaches using MPEQ
> [sic, presumably 'MPEG'], the rejection based on
> inherency is correct." Answer at 18. However, under
> applicable law, as the Honorable Board is well aware,
> unless the prior art as a whole, including any
> contraindications contained therein (such as, e.g.
> mutually contradictory teachings), suggests the
> desirability of the selective combination proffered by

the Examiner, the prior art cannot render obvious the claims on appeal. Thus, the Examiner's position is contrary to law, and cannot serve as a proper basis for rejecting the subject application.

In order for us to decide the question of obviousness, "[t]he first inquiry must be into exactly what the claims define." **In re Wilder**, 429 F.2d 447, 450, 166 USPQ 545, 548 (CCPA 1970). "Analysis begins with a key legal question-- what is the invention claimed ?...Claim interpretation...will normally control the remainder of the decisional process." **Panduit Corp. v. Dennison Mfg.**, 810 F.2d 1561, 1567-68, 1 USPQ2d 1593, 1597 (Fed. Cir. 1987), **cert denied**, 481 U.S. 1052 (1987).

We note that independent claim 1 reads in part as follows:

> "performing motion compensation for the downsampled image in the spatial domain, the performing of the motion compensation comprising scaling a motion vector in accordance with a donwsampling ratio, the motion vector specifying relative distance of reference data from a macroblock"

Appellants' specification indicates that the motion compensation includes scaling a motion vector, and that motion compensation is performed to compensate for the down-sampled image.

Particularly, at page 8, line 9 to page 9, line 9, Appellants'

specification states that:

> "Therefore, one advantage of this approach is that it
> provides greater flexibility. In such an embodiment, the
> decoder software may transfer the downsampled prediction
> error to the motion compensation hardware and the motion
> vectors may be adjusted substantially in accordance with the
> downsampling ratio, as explained hereinafter. In this
> particular embodiment, although, again the invention is not
> limited in scope in this respect, downsampling ratios of
> 1:1, 2:1, 4:1, and 8:1, along either of the horizontal,
> vertical or both directions, may be supported. In this
> particular embodiment, where MPEG2 is employed, the
> downsampling ratio is limited to no more than 8:1 due to the
> native eight-by-eight MPEG2 block size. However, this
> limitation may not apply in alternative embodiments.
> Furthermore, in alternative embodiments, even for MPEG2,
> downsampling ratios other than a power of two may be
> implemented, such as, for example, 3:1.

> [0027] As illustrated in FIG. 2, the motion compensation
> hardware may operate directly on the downsampled bit stream.
> In this particular embodiment, where MPEG2 is employed, the
> downsampling ratio may be n, where n equals 1, 2, 4, and 8.
> In a motion compensation process, a motion vector of a
> processed macroblock specifies the relative distance of
> reference data from the processed macroblock. Let $(V.sub.x,
> V.sub.y) = (vector[r][0], vector[r][1])$ be the original motion
> vector for a macroblock, where V.sub.x and V.sub.y, the
> horizontal and vertical components of the motion vector, are
> in the form of 16-bit signed value, although the invention
> is not limited in scope in this respect. According to the
> MPEG2 standard, the least significant bit (LSB) of V.sub.x
> and V.sub.y is used to indicate the half-pixel resolution
> reference."

Thus, the claim does require performing motion compensation

for the down-sampled image in the spatial domain, wherein the

step of performing the motion compensation includes the further

step of scaling a motion vector in accordance with a down

sampling ratio, and wherein the motion vector specifies the

relative distance of reference data from a macroblock.

Now, the question before us is what Vetro, Ng and Bose would have

taught to one of ordinary skill in the art? To answer this

question, we find the following facts:

1.   Vetro states at page 4, section 2, paragraphs 1 and 2, the

following:

> The focus of this section is to provide an expression for
> the optimal set of low-resolution MC filters given a set of
> down-conversion filters. The resulting filters are optimal
> in the least squares sense as they minimize the mean square
> error between a reference block and a block obtained through
> low-resolution MC. The results which have been derived in
> [8] assume that a spatial domain filter, x, is applied to
> incoming macroblocks to achieve the down-conversion. The
> scheme shown in Fig. 3(a) illustrates the process by which
> reference blocks are obtained. First, full-resolution
> motion compensation is performed on macroblocks, a, b, $\underline{c}$,
> and $\underline{d}$ to yield, h. To execute this process, the filters
> $S_a^{(r)}$, $S_b^{(r)}$, $S_c^{(r)}$, and $S_d^{(r)}$ are used. Basically, these
> filters represent the masking/averaging operations of the
> motion compensation in a matrix form. More on the
> composition of these filters can be found in the appendix.
> Once $\underline{h}$ is obtained, it is down-converted to $\underline{h}$ via the
> spatial filter, x:
> (1)
> $$\underline{h} = \underline{xh}.$$

2.   Vetro states, at page 11, Section 4.3, first paragraph, the

following:

> To perform low-resolution MC, the high-definition
> motion vector must specify the neighborhood of blocks
> in which to filter. Once these blocks are retrieved

from the frame store, a filtering operation is applied.
The set of filters which are used to operate on the
reference blocks are specified by the amount of overlap
as indicated by $y1$ and $y2$ (see appendix and Fig 12) and
the prediction mode. Once this filtering is performed,
the low-resolution prediction can be added to the
residual component to form the reconstructed block.

3.   Ng states, in column 5, line 60- column 6, line 7, the

following:

FIG. 5 illustrates a further embodiment which produces
improved images over the FIG. 4 embodiment. The
improvement results because advantage is taken of the
total motion vectors not truncated motion vectors_or
the affects of truncating memory addresses to the VRAM
315. In FIG. 5 an interpolator 319 is interposed
between the VRAM 315 and the predictor 304. In
addition a two dimensional decimator 313, similar to
decimator 311, is interposed between the predictor 304
and the adder 312. The interpolator 319 accepts blocks
of data from the VRAM 315 and generates 8 by 8 blocks
which are coupled to the predictor. The predictor
couples the 8 by 8 blocks of data to the decimator 313
which subsamples the data back down to 4 by 4 blocks of
data in conformance with the data format applied to the
adder from decimator 311.

4.   Bose states, in column 17, lines 4-15, the following:

An example of how motion compensation is carried out
with the memory map in Fig. 12 where the luminance or
4:2:2 chrominance data of a full frame macroblock S_p of
a P-picture, say in buffer 73B, is to be rewritten with
a 16x16 pel square 90 (superimposed on Fig. 12 for
illustration) of data from a reference I- or P-picture

>   that is displaced, as specified by a motion
>   compensation vector 88, at some relative vertical and
>   horizontal distance in buffer 73A. The motion vector
>   88 may specify, for example, that the 16x16 pel square
>   90 that is to be copied is located, for example 25½
>   pels below and 23 pels to the right of the macroblock
>   to be reconstructed.

With the above discussion in mind, we find that the Vetro,

Ng and Bose combination teaches the claimed invention. First,

Vetro substantially teaches the limitations set forth in

representative claim 1. Particularly, we find that Vetro teaches

a frequency domain down-conversion of HDTV using a low-resolution

motion compensation (MC) scheme that includes specifying high

definition motion vectors in the neighborhood of blocks in which

to filter, following a down conversion scheme. See page 9,

section 4.1, page 10, section 4.2 and page 11, section 4.3. We

also find that Vetro provides adequate motivation for this

combination by suggesting that the resulting filtering scheme

minimizes the mean square error between a reference block and a

block obtained through the low resolution MC to thereby perform a

motion compensation on macroblocks a, b, c, and d to yield h. See

page 4, section 2. Next, we find that Ng complements Vetro's

teachings by suggesting the use of motion vectors in a motion compensation scheme following the down-sampling of HDTV compressed digital images. We also find that Ng provides motivation for this combination by indicating that the suggested approach offers the advantages of reduced memory, slightly enhanced resolution and lessened computational speed requirements. See column 6, lines 50-54. Additionally, we find that Bose further reinforces the Vetro and Ng combination through its explicit teaching of a motion vector in a motion compensation scheme for digital video, wherein the motion vector specifies a relative vertical or horizontal distance from a reference data to a macroblock. We also find that Bose provides proper motivation for this combination by suggesting that this approach provides the benefits of faster image retrieval from memory, as well as efficient copying or reconstruction of video images. See column 6, lines 7-11.

We agree with the Examiner that the combination of Vetro, Ng and Bose does satisfy the claimed limitation of performing motion compensation for the down-sampled image in the spatial domain, wherein the step of performing the motion compensation includes

the further step of scaling a motion vector in accordance with a down sampling ratio, and wherein the motion vector specifies the relative distance of reference data from a macroblock. We also find that the motivation to combine the references is proper. First, the motivation to combine these references was taken from the references themselves. Second, all three the references are within the same field of endeavor. Third, all three references pertain to the same solution of enhancing image resolution while reducing memory requirement.

It is therefore our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would have suggested to one of ordinary skill in the art the invention as set forth in claims 1-7, 9, 11-12, 16-19, 21-24, 28-30 and 32-34. Accordingly, we will sustain the Examiner's rejection of claims 1-7, 9, 11-12, 16-19, 21-24, 28-30 and 32-34.

II. Under 35 USC 103, is the Rejection of Claims 8 and 31 as Being Unpatentable over the combination of Vetro, Ng, Bose and Kim Proper?

With respect to dependent claims 8 and 31, Appellants argue at pages 34 and 35 of the Appeal Brief that the Vetro, Ng and Bose combination is deficient, and it does not teach the claimed invention, as recited in the independent claims from which claims 8 and 31 directly depend. Appellants also argue that Kim[3] does not cure these deficiencies. As noted in the discussion of claim 1 above, we find that no such deficiencies exist in the rejection, and that the Vetro, Ng and Bose combination properly teaches the limitations in question. Consequently, we agree with the Examiner that the combination of Vetro, Ng, Bose and Kim also teaches the claimed invention.

It is our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would have suggested to one of ordinary skill in the art the invention as set forth in claims 8 and 31. Accordingly, we will sustain the Examiner's rejection of claims 8 and 31.

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3 Kim is relied upon for its teaching of displaying down-sampled spatial image such that the resulting non-uniform vertical spacing of data signal lines appear substantially uniform on a low resolution monitor screen.

III. Under 35 USC 103, is the Rejection of Claims 14 and 26 as Being Unpatentable over the combination of Vetro, Ng, Bose and Dugad Proper?

With respect to dependent claims 14 and 26, Appellants argue at pages 33 and 34 of the Appeal Brief that the Vetro, Ng and Bose combination is deficient, and it does not teach the claimed invention, as recited in the independent claims from which claims 14 and 26 directly depend. Appellants also argue that Dugad[4] does not cure these deficiencies. As noted in the discussion of claim 1 above, we find that no such deficiencies exist in the rejection, and that the Vetro, Ng and Bose combination teaches the limitations in question. Consequently, we agree with the Examiner that the combination of Vetro, Ng, Bose and Dugad also teaches the claimed invention.

It is our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would have suggested to one of ordinary skill in the art the invention as set forth in claims 14 and 26. Accordingly, we will sustain the Examiner's rejection of claims 14 and 26.

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4 Dugad is relied upon for its teaching of bilinear interpolation scheme for

IV. Under 35 USC 103, is the Rejection of Claims 15 and 27 as Being Unpatentable over the combination of Vetro, Ng, Bose, Dugad and Rosman Proper?

With respect to dependent claims 15 and 27, Appellants argue at pages 35 and 36 of the Appeal Brief that the Vetro, Ng, Bose and Dugad combination is deficient and it does not teach the claimed invention as recited in the independent claims from which claims 15 and 27 indirectly depend. Appellants also argue that Rosman[5] does not cure these deficiencies. As noted in the discussion of claim 14 and 26 above, we find that no such deficiencies exist in the rejection, and that the Vetro, Ng, Bose and Dugad combination teaches the limitations in question. Consequently, we agree with the Examiner that the combination of Vetro, Ng, Bose, Dugad and Rosman also teaches the claimed limitation.

It is our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would have suggested to one of ordinary skill in the art the invention as set forth in claims 15 and 27. Accordingly, we will sustain the Examiner's rejection of claims 15 and 27.

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down-sampling.
5 Rosman is relied upon for its teaching of using a 3D pipeline to perform bilinear interpolation.
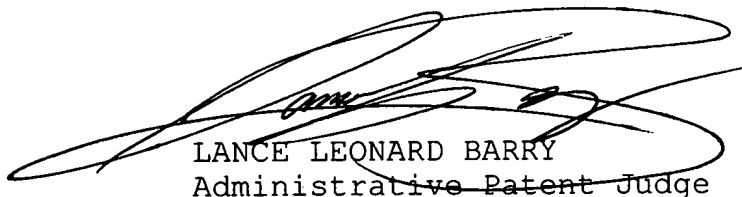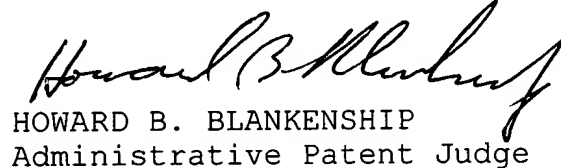
CONCLUSION

In view of the foregoing discussion, we have sustained

the Examiner's decision rejecting claims 1-9, 12-21 and 23-34

under 35 USC 103.   Therefore, we affirm.

No time period for taking any subsequent action in

connection with this appeal may be extended under

37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

LANCE LEONARD BARRY   )
Administrative Patent Judge)
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)
) BOARD OF PATENT
HOWARD B. BLANKENSHIP   )
Administrative Patent Judge)   APPEALS AND
)
) INTERFERENCES
JEAN R. HOMERE   )
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Appeal No. 2006-1605
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